Phys 111 2023

Review 3

Exam 3 - In class Monday

Covers: Ch 7.1 → 7.5, 8.1, 9, 10

Bring: * Calculator - not communicating device

* Previous two note cards each 3"x5" single side
One more note card 3"x5" single side.

Study: 2016 Exam 3 all by Q6b

2019 Exam 3 all Q.

* HW, Discussions
* Quizzes
* Number questions in class.

Ch10 Energy

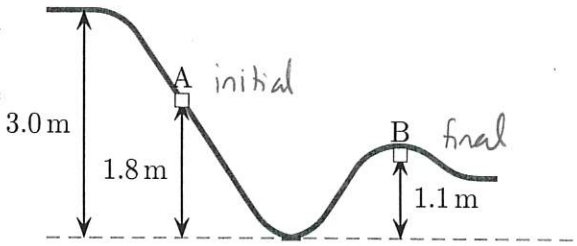
$W = Fd\cos\theta$ $W_{net} = \Delta K$ $K = \frac{1}{2}mv^2$ $U_{grav} = mgy$ $U_{spring} = \frac{1}{2}k$

$E = K + U_{grav} + U_{spring}$ $P = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t}$ Energy conservation $E_f = E_i$

Quiz 1 70% - 95%

241 Skate park, 2 state mass 60kg

A skater moves down a ramp at point A with speed 3.0 m/s. The skater slides along the illustrated track. Ignore friction and air resistance. Determine the speed of the skater at point B. *(111F2023)*



Answer: Work done by non-conservative forces is zero. Thus energy is conserved

$v_i = 3.0\,m/s$ $v_f =$

$y_i = 1.8\,m$ $y_f = 1.1\,m$

$$E_f = E_i$$

$$K_f + U_{grav\,f} = K_i + U_{grav\,i}$$

$$\frac{1}{2}mv_f^2 + mgy_f = \frac{1}{2}mv_i^2 + mgy_i$$

$$\frac{1}{2}\,60kg \times v_f^2 + 60kg \times 9.8\,m/s^2 \times 1.1m = \frac{1}{2}\,60kg \times (3.0\,m/s)^2 + 60kg \times 9.8\,m/s^2 \times 1.8m$$

$$30kg\,v_f^2 + 647J = 270J + 1058J$$

$$30kg\,v_f^2 = 1328J - 647J$$

$$= 681J$$

$$v_f^2 = \frac{681J}{30kg} = 22.7\,m^2/s^2$$

$$v_f = \sqrt{22.7\,m^2/s^2} \Rightarrow v_f = 4.8\,m/s$$

Quiz 2 80% - 100%

Ch 9.2 → 9.5

$\vec{p} = m\vec{v}$ $\quad \vec{p}_{tot} = \vec{p}_1 + \vec{p}_2 + \ldots$ VECTORS

No net external force $\Rightarrow \vec{p}_{tot}$ constant

Quiz 3 60% - 90%

Additional Problems

309 ~~Ball~~ Brick thrown back and forth

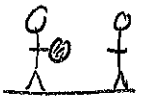
Two people, each mass 70 kg, stand at opposite ends of a small 100 kg cart. The person on the left holds a 10 kg brick. They are all at rest initially. *(111F2023)*

a) The person on the left throws the brick to the person on the right horizontally with speed 8.0 m/s. Determine the speed of the cart after the ~~ball~~ brick has been launched.

b) The person on the right catches the ~~ball~~ brick and eventually holds it at rest relative to the cart. Determine the speed of the cart after this.

Answer: a) total momentum is conserved

Initial



Final

$V_{brick\ i} = 0$ m/s $\qquad V_{brick\ f} = 8.0$ m/s

$V_{cart\ people\ i} = 0$ m/s $\qquad V_{cart\ people\ f} = ?$

$$p_{tot\ f} = p_{tot\ i}$$

$$m_b v_{brick\ f} + m_{cart\ people} v_{cart\ people\ f} = \overset{0}{m_b v_{brick\ i}} + \overset{0}{m_{cart\ people} v_{cart\ people\ i}}$$

$$= 0 \text{ kg m/s}$$

$$10\text{kg} \times 8.0\text{m/s} + 240\text{kg}\ v_{cart\ people\ f} = 0 \text{ kg m/s}$$

$$240\text{kg}\ v_{cart\ people\ f} = -80 \text{ kg m/s}$$

$$v_{cart\ people\ f} = -\frac{80 \text{ kg m/s}}{240 \text{ kg}} = -0.33 \text{ m/s}$$

b) The total momentum is zero. Since all have the same velocity, the velocity will be zero.

Ch 7.1 → 7.6

$2\pi \text{ rad} = 1 \text{ rev} = 360°$ $\quad \omega = \frac{\Delta\theta}{\Delta t}$ $\quad \alpha = \frac{\Delta\omega}{\Delta t}$ $\quad v = \omega r$

$\tau = rF\sin\phi$ $\quad \tau_{net} = I\alpha$ $\quad I = m_1 r_1^2 + m_2 r_2^2 + \dots$

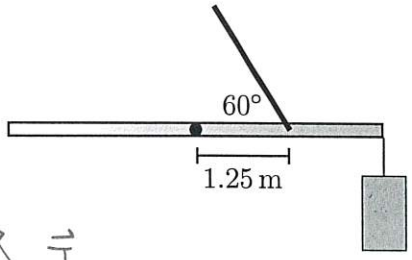
diagram.

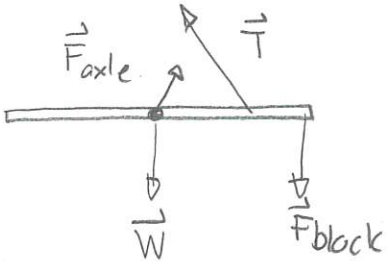
Quiz 4 ~~50%~~ → 10%

weight of rod is tricky

300 Balanced rod, unknown mass

A ~~2.5~~ 5.0 m long rod can pivot about an axle through its midpoint. A block is suspended at the illustrated point. A rope is attached 1.25 m from the midpoint and pulls with tension 80 N at the illustrated angle. The thickness of the rod is negligible. Determine the mass of the suspended block that will keep the rod at rest horizontally. *(111F2023)*





Answer: $\tau_{net} = 0$

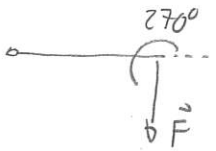
$\tau = rF\sin\phi$

Axle: $r = 0 \Rightarrow \tau_{axle} = 0$

Gravity $r = 0 \Rightarrow \tau_{grav} = 0$

Block $\tau_{block} = 2.5\,m \times M_{block} \times 9.8\,m/s^2 \sin 270^\circ$ $\quad F_{block} = M_{block}\,g$

$= -24.5\ m^2/s^2\ M_{block}$



Tension $\tau_{rope} = 1.25\,m \times 80\,N \times \sin 120^\circ$

$= +87\ N\cdot m$

$\tau_{net} = 0 \Rightarrow -24.5\ m^2/s^2\ M_{block} + 87\,N\cdot m = 0$

$\Rightarrow 24.5\ m^2/s^2\ M_{block} = 87\,N\cdot m$

$\Rightarrow M_{block} = \dfrac{87\,N\cdot m}{24.5\ m^2/s^2} \Rightarrow M_{block} = 3.5\,kg$

Quiz 5